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HAND GRINDER

Prior Art

The present invention is based on a hand grinder as generically defined by the preamble to claim 1.

From British Patent Application GB 2 322 582, a motor-driven hand grinder is known which is provided with a system for clamping and tightening, i.e. making taut, a grinding sheet that can be mounted on the underside of its grinding disk. This system functions reliably and is easy to manipulate, but the effect of making the grinding sheet taut is relatively limited, and hence a perceptible relative motion between the grinding sheet and the grinding disk cannot be precluded.

Advantages of the Invention

The invention having the characteristics of claim 1 has the advantage that an inexpensive hand grinder is created that by simple means enables highly effective clamping and at the same time effectively making the grinding sheet taut on the grinding disk, in which a relative motion between the grinding sheet and the grinding disk is as good as precluded, and because the pivot shaft of the clamping body is located substantially vertically above the clamping point, on top of the grinding disk above the mounting face, and because the mounting face spaced apart from pivot shaft in a defined way is curved, an especially long slaving path is provided for making the grinding paper taut.

Because the clamping body is equipped as a cylindrical

roller, and the associated region of the top of the grinding disk is equipped as a concave hollow-cylindrical groove, upon pivoting of the clamping body what occurs first is a thrusting slaving of the grinding sheet on the top of the grinding disk, until it is made as taut as is maximally possible. Upon displacement of the grinding sheet, the contact pressure between the clamping body and the mounting face of the grinding disk simultaneously increases considerably, so that when the highest clamping and locking force is reached, while the end of the grinding sheet is firmly held, a maximum tightening effect prevails at the same time.

Because the clamping body is provided with a plastic hose as its friction lining, and in particular one carried by a metal core, a clamping body of simple construction with a good grip is created.

Because the metal core of the clamping body firmly holds one clamping lever each, particularly on both of its axial ends, in a way secured against relative rotation and in captive fashion, particularly by means of radial and axial bores into which the clamping lever can be inserted or placed, the clamping body is especially sturdy and is capable of transmitting strong tightening and clamping forces uniformly and gently and in a positionally secured way to the grinding sheet.

Because the clamping lever can be locked in a spring-prestressed fashion in its clamping position, particularly by an end remote from the edge, the clamping force on the grinding sheet does not lessen.

Because the metal core has axial grooves on its

circumference, and to which the bent-over regions of the slaving levers can be placed and extend with flush contours with the core, the slaving levers are mounted especially securely by the plastic hose slipped over the core.

Because the mounting face extends at an angle to the pivoting path of the clamping body that is close to self-locking, especially secure clamping of the grinding sheet, yet with easy release, is possible.

Because in the release position of the clamping body, there is a slit between the clamping body and the mounting face, into which slit the end of the grinding sheet can be inserted beneath and/or onto the clamping body, the grinding sheet can be clamped especially securely.

Because the mounting face is curved, in particular in concave fashion, and extends toward the outermost pivot circle, leading to the shaft, of the clamping body in the region near the edge of the grinding disk with a spacing amounting to several millimeters and intersects the pivot circle in the region remote from the edge, a stop for the clamping body is created with which secure clamping of the grinding sheet is possible.

Because the clamping body has at least two eccentric cams, which in particular are on the order of round teeth and which extend parallel to its shaft and/or to the top of the grinding disk over the width of the clamping body, the radius of which eccentric cams relative to the pivot shaft is greater than the spacing between the pivot shaft and the mounting face, the latter in particular extending rectilinearly and smoothly, the grinding sheet can be tightened especially securely directly after being clamped.

Because the clamping body, and in particular its eccentric cams and/or the mounting face - at least in part - comprise elastically deformable material - the clamping device is automatically adaptable to grinding sheets of different thickness that are to be clamped.

Because a threshold, which in particular is rounded, is located on the front and rear edge of the grinding disk and by way of it the end of the grinding sheet can be guided such that this end is located in floating fashion between the threshold and the mounting face, and after being clamped it can be made taut by simply pressing down on the floating region.

Because between the front and rear edges on the top of the grinding disk there is an indentation in the grinding disk, into which the grinding sheet guided over it can be pressed, and the indentation is elastically spanned, in particular by a leaf spring, the grinding sheet after being clamped can be made taut by pressing down on its region located in floating fashion.

Because the leaf spring can be pressed jointly with the grinding sheet into the indentation by means of the second eccentric cam, it is not only made taut but also reliably clamped at a further point.

Because the second eccentric cam has a greater diameter than the first, it forms a rotation stop, past which the clamping body cannot be rotated farther, and which defines the clamping position of the clamping body.

Because the first eccentric cam, in the clamping

position, is located at least 2 mm in front of and parallel to the vertical extending from the pivot shaft to the mounting face, and in the process the eccentric cams are braced, spreading away from one another, on the mounting face, the clamping position is adjustable in overlocking fashion in a markedly perceptible way and can be released in overlocking fashion only counter to a resistance, precluding an unintentional release.

Drawing

The invention is described in further detail below in terms of an exemplary embodiment and in conjunction with the drawing.

Shown are

Fig. 1, a three-dimensional view of the hand grinder of the invention;

Fig. 2, a detail of the hand grinder showing the clamping means for clamping the grinding sheet;

Fig. 3, a three-dimensional of the detail of Fig. 2 in the clamping position;

Fig. 4, the view of Fig. 3 in the open position;

Fig. 5, a further variant of the grinding sheet clamping device in the release position;

Fig. 6, the grinding sheet clamping device of Fig. 5 in the clamping position;

Fig. 7, a grinding disk with grinding sheet clamping devices as in Fig. 5; and

Fig. 8, the geometric detail of a clamping roller of Figs. 5 and 6.

Description of the Exemplary Embodiment

A hand grinder 10 - a hand-held vibrating grinder - shown laterally from the front in Fig. 1 has a housing 12, whose upper region serves as a handle 13 and whose lower region has a grinding disk 14, which can be driven by a motor to vibrate and to whose underside 18 a grinding sheet 20 can be secured. The grinding sheet 20, with two diametrically opposite ends 21, wraps around the front and rear edges 15, 17 of the grinding disk 14. The ends 21 of the grinding sheet each protrude for some distance parallel to the top 16 of the grinding disk 14 toward its center. The ends 21 of the grinding sheet can be clamped in such a way as to make them taut between a mounting face 22 on the top 16 and clamping roller 24. The clamping roller 24 is pivotable by means of a clamping lever 30. The clamping lever 30 extends, bent 90°, from the clamping roller 24 parallel to the length of the grinding disk 14. The end of the clamping lever 30 is pivotable upward, in the viewing direction, into the clamping position of the clamping roller 24, or in other words counterclockwise, and can be locked in elastically prestressed and overlocking fashion to the top 16 in an abutment 31 in the clamping position.

The grinding sheet 20, on its underside, has a layer 44 of abrasive, which when the grinding sheet 20 is placed between the clamping roller 24 and the mounting face 22, in the placement direction indicated by the arrow 42, faces

toward the clamping roller 24. From the roughness of the abrasive layer 44, especially good adhesion exists upon contact with the clamping roller 24, so that upon pivoting of the clamping roller 24 into the clamping position, the end 21 of the grinding sheet is carried along, adhering to the clamping roller, and is then securely clamped against being lost. The grinding sheet 20 is fixed to the underside 18 of the grinding disk 14 in such a way that it is made taut and is secured against relative motion. As a result, the grinding stroke of the grinding disk 14 is transmitted to the grinding sheet 20 without slip and with high efficiency. The removal power in grinding is correspondingly high, creating a constantly homogeneous grinding pattern that is virtually independent of the contact pressure with which the hand grinder is pressed against a workpiece to be machined.

Fig. 2 shows an enlarged detail of the right-hand side of the front region of the grinding disk 14. A bearing block 32 protrudes past its top 16 on each side and, with a central bore not identified by reference numeral, receives a pivot shaft 28 of the clamping roller 24, about which shaft this clamping roller is pivotably supported. A rigidly secured clamping lever 30 protrudes from the clamping roller 24 and is bent at a right angle to the pivot shaft 28. In the clamping position of the clamping roller 24, it extends parallel to the length of the grinding disk and is lockable in overlocking or spring-prestressed fashion to a bearing-blocklike abutment 31 on the top 16 of the grinding disk. In this final position of the clamping lever 30, the clamping roller 24 is in its outermost left-hand pivoted position, in which it rests on the stoplike pressure region 26 that rises in concave fashion on the mounting face 22, and firmly holds a grinding sheet that is clamped between the clamping roller 24 and the mounting face 22.

In this clamping position, the center 36 of curvature of the clamping roller 24 has a position located near the center of curvature of the mounting face 22. The curvature profile 38 of the mounting face 22 is substantially equivalent to the radius 37 of curvature of the clamping roller 24. The mounting face 22 is located in the pivot circle of the clamping roller 24 such that it forms a stop with the negative contour of the clamping roller 24. As a result, a large surface area of the clamping roller 24 rests on the mounting face 22, or the pressure region 26.

The front edge 15, located on the right in the viewing direction, of the grinding disk 14 is curved in convex form in longitudinal section, so that a grinding sheet 20 wrapped around it can slide away past it relatively easily, without the threat of tearing.

The mounting face 22 extends from the front edge 15 to the pressure region 26 in such a way that opposite the pivot circle of the clamping roller 24, it forms an acute-angled slit 46. The grinding sheet 20 can enter this slit 46 between the clamping roller 24 and the mounting face 22, if the clamping roller 24 is pivoted far enough counterclockwise and upward about the shaft 28 - that is, in the release direction. If then, after the grinding sheet 20 is put in place, the clamping roller 24 is rotated clockwise about the shaft 28 back into its clamping position, then initially it pulls the grinding sheet 20 in slaved fashion along with it via the mounting face 22, until together with the end 21 of the grinding sheet it comes to rest on the pressure region 26 of the mounting face 22 and firmly holds the grinding sheet 20 securely taut, in captive fashion. By clamping and the end 21 of the grinding sheet on both the front and the rear edges

15, 17 of the grinding disk 14 and making it taut, the grinding sheet 20 is made taut twice and is fixed in a way secure against shifting relative to the underside 18 of the grinding disk. Slip-free grinding with high efficiency is thus possible, because a relative motion of the grinding sheet 20 with respect to the grinding disk 14 is precluded.

For removal of the grinding sheet 20 from the grinding disk 14, the clamping lever 30 is pivoted laterally outward and farther downward out of its locked position in the abutment 31. In the process, the clamping roller 24 moves with it counterclockwise, whereupon the slit 46 increases in size, and finally the end 21 of the grinding sheet is released, so that the grinding sheet 20 is easily removable.

Fig. 3 shows a three-dimensional view of the details, substantially explained in conjunction with Fig. 2, of the front edge 15 - seen from the left-hand side; this need not be explained in every detail again here. The clamping roller 24 has been pivoted into its clamping position, in which it firmly clamps the end 21 of the grinding sheet 20 at the concave mounting face 22 and secures it against being lost.

The clamping roller 24 is joined in a manner fixed against relative rotation to an eccentric pivot shaft 28 above the pressure region 26, and the pivot shaft 28 changes over, on both sides of the clamping roller 24, in each case after a bend into a respective clamping lever 30. Each clamping lever 30 may comprise spring wire, so that the clamping roller 24, in its clamping position, presses the end 21 of the grinding sheet against the pressure region 26 in spring-prestressed fashion.

Fig. 4 shows the same region of the grinding disk 14

and the clamping roller 24 as in Fig. 3, but in the "open" position, in which the slit 46 between the mounting face 22 and the clamping roller 24 is so large that the end 21 of the grinding sheet can conveniently be inserted far enough that when the clamping roller 24 is pivoted downward this end is carried along by the clamping roller 24 and thrust along the mounting face 22 - to the right in the viewing direction - and finally becomes clamped in its final position in the pressure region 26 of the mounting face 22. The clamping levers 30 are oriented perpendicularly downward in this state, and in this position they keep the clamping roller 24 in its "open" position.

Fig. 5 is a side view of a further exemplary embodiment of a grinding disk 140, which on its underside 180 has a grinding sheet 200 extending parallel to the underside; with its end 210, this grinding sheet is wrapped around the front edge 150 of the grinding disk 140 and guided over its top 160 in such a way that it is positioned between the top 160 and the circumference of a partly cylindrical clamping roller 54. The clamping roller 54 is supported rotatably about a pivot shaft 280 in a bearing block 320, and with an axial annular collar 55 it reaches through a fittingly circular recess, acting as an abutment 310, in the bearing block 320. Two eccentric cams 56, 57 are located on the circumference of the clamping roller 54, parallel to the shaft 280 of the clamping roller 54; the first eccentric cam 56 extends remote from the edge toward the front edge 150 and has a markedly lesser eccentricity - measured relative to the pivot shaft 280 - than the second eccentric cam 57, which is seated in the region near the edge of the clamping roller 54. The two eccentric cams 56, 57 are spaced apart from one another by one tooth gap 59.

The clamping roller 54 can be pivoted by hand toward the grinding disk 140 into its clamping position by means of a clamping lever 60 that points radially outward, toward the front edge 150. In this pivoting process, the eccentric cam 56 remote from the edge is first thrust over the end 210 of the grinding sheet and pulls it, making it taut, to the right across the top 160 of the grinding disk 140, until the second eccentric cam 57 is pivoted downward and is braced on the end 210 of the grinding sheet, or on the top 160 of the grinding disk 140. Since the end 210 of the grinding sheet spans a threshold 64 of partly cylindrical or rounded cross section, this end is located in floating fashion between the threshold 64 and the first eccentric cam 56, until it presses the second eccentric cam 57 down onto the top 160. Pressing the floating grinding sheet region downward onto the top 160 of the grinding disk 140 by means of the second eccentric cam 57 draws the grinding sheet 200 farther to the right in the longitudinal direction and thus makes it still more taut. It is assumed here that the end 210 of the grinding sheet, positioned on the rear edge 170, not also shown here, diametrically opposite the front edge 150 was fixed beforehand, because otherwise, or in other words upon yielding of the diametrically opposite end of the grinding sheet, the tightening is undone.

Fig. 6 shows the clamping roller 54 of Fig. 5 in the "closed" position - unlike Fig. 5, which shows it in the "open" position. The first eccentric cam 56, remote from the edge, is positioned approximately 2 mm to the right of the pivot shaft 280, in the viewing direction, and the second eccentric cam 57, near the edge, is braced via the grinding sheet 200, or its end 210, on the top 160 of the grinding disk 140. The second tightening step is thus completed, in which the end 210 of the grinding sheet is pulled to the

right in the viewing direction across the threshold 64 and kept taut.

By making the grinding sheet taut twice on both ends 150, 170 of the grinding disk 140, a relative motion between the grinding sheet 200 and the underside 180 of the grinding disk 140 is especially reliably prevented, so that as the grinding disk 140 moves back and forth over a workpiece, especially effective grinding is possible.

The grinding disk 140 of Figs. 5 and 6, shown in Fig. 7 as a three-dimensional top view, has on each of its two ends an identical, partly cylindrical clamping roller 54, whose clamping levers 60 are oriented toward the front edge 150 and rear edge 170, respectively, and can easily be pivoted slightly downward into the clamping position by hand, in particular using the thumb.

For releasing the grinding sheet 200, the clamping levers 60 should be pivoted upward in the viewing direction, so that the eccentric cams 56, 57 open up a gap between the top 160 of the grinding disk 140 and the clamping roller 54, out of which gap the end 210 of the grinding sheet can easily be removed.

Fig. 8 shows a schematic cross section of a clamping roller 54, pivoted into the clamping position, in which the first eccentric cam 56, remote from the edge, braces the end 210 of the grinding sheet on the mounting face 62 of the top 160 of the grinding disk 140. The eccentric cam 56 has a parallel spacing 63 of a few millimeters from the plumb line dropped from the pivot shaft 280 to the mounting face 260 so that a prestressed position of the clamping roller 54 is thus accomplished. The clamping roller 54 comprises elastic

material. Its overlocking is therefore possible by elastic deformation of the first eccentric cam. It may furthermore be advantageous if the mounting face 62 likewise comprises elastically deformable material, on which the end 210 of the grinding sheet and the two eccentric cams 56, 57 are braced. As a result, different thicknesses of grinding sheet can be clamped in a way that makes them taut, with the same secure hold, regardless of their masses.

The first eccentric cam 56, in its clamping position after its overlocking, builds up an elastic prestressing force relative to the mounting face 62 with which it presses the second eccentric cam 57 against the top 160 of the grinding disk 140, and the latter presses the end 210 of the grinding sheet downward with precisely this prestressing force into an indentation 66 and thus additionally afterward. The indentation 66 may be spanned by elastic means, such as plastic or a leaf spring.

Instead of a clamping lever 60 integrated with the clamping roller 54 and pointing outward toward the grinding disk edge 150, 170, a clamping lever may be located as shown in Figs. 1 through 4, which in the clamping position points in each case toward the center of the grinding disk 140, where it is lockable in overlocking fashion.